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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/618,220	07/11/2003	Jingyi Bai	MIO 0109	4413
7590	09/21/2004		PA/04509.247/02-	
Killworth, Gottman, Hagan & Schaeff, L.L.P. Suite 500 One Dayton Centre Dayton, OH 45402-2023			EXAMINER	
			ROCCHEGIANI, RENZO	
			ART UNIT	PAPER NUMBER
			2825	

DATE MAILED: 09/21/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

10/618,220

Applicant(s)

BAI ET AL.

Examiner

Renzo N. Rocchegiani

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 25 June 2004.  
2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.  
3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-29 is/are pending in the application.  
4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.  
5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.  
6) ☒ Claim(s) 1-29 is/are rejected.  
7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.  
8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.  
10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).  
11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All b) ☐ Some \* c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).  
\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)  
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)  
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_.  
4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_\_.  
5) ☐ Notice of Informal Patent Application (PTO-152)  
6) ☐ Other: \_\_\_\_\_.

## DETAILED ACTION

### *Claim Rejections - 35 USC § 103*

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1-10, 12, 21-22, and 24-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,030,881 (Papasouliotis et al.).

Papasouliotis et al. disclose a method for filling a shallow trench insulation structure with a high aspect ratio, i.e. higher than 5:1, (col. 4, lines 50-60) to be used as an intermetal dielectric by way of HDP-CVD (col. 4, lines 50-60) comprising cycles (col. 6, lines 8-13) of a two step process that uses a silicon source gas such as silane, an oxide source gas such as oxygen and an inert gas, such as He, during the HDP-CVD (col. 6, lines 40-50) at the respective flow rates (See Tables 1 and 2) wherein the etch to deposition ratio of one step is higher than the second (col. 7, lines 1-7 and col. 7, lines 53-58) and wherein the etch to deposition ratio is varied from one step to the other by modifying flow rates of the source gases and by changing the RF power of the bias to the substrate, (col. 8, lines 42-47). The process discloses in Papasouliotis et al. results in the deposition of silicon dioxide (col. 5, lines 27-31) wherein the layers form a v-shape that is later filled in. (Fig. 1A-D).

Papasouliotis et al. does not specify that the bias and/or flow rate in one step are higher/lower than the other.

It would have been obvious to one of ordinary skill in the specific art to have the two steps one with high RF bias and the other with a high flow rate, since Papasouliotis et al. disclose that such variables are result effective because by changing those variables one affects the etch to deposition ration and thus being recognized as result effective variables discovering their optimum value involves only routine skill in the art. *In re Boesch*, 617 F.2d 272 (CCPA 1980).

3. Claims 11, 13-20, and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,030,881 (Papasouliotis et al.) in view of U.S. Patent No. 5,872,058 (Van Cleemput et al.).

As stated in paragraph 2, all the limitation of these claims have been met except for teaching that the inert gas may comprise hydrogen, that the trench may be covered with a nitride liner prior to the deposition of the silicon oxide.

Van Cleemput et al. teaches a method of filling a high aspect ratio trench isolation structure with silicon dioxide in a HDP-CVD process wherein silane and oxygen are used with hydrogen (col. 3, lines 32-37) as the inert gas and wherein the trench is lined with a nitride layer prior to the deposition of the silicon oxide. (col. 3, lines 22-27)

It would have been obvious to one with ordinary skill in the specific art to combine the teachings of Van Cleemput et al. to those of Papasouliotis et al., since Van Cleemput et al. teaches that hydrogen may be exchanged for argon, another gas inert gas that Papasouliotis et al. discloses may be used, and since the silicon nitride layer would provide protection to the sidewalls. (See Van Cleemput et al. col. 3, lines 20-40).

***Response to Arguments***

4. Applicant's arguments filed June 25, 2004 have been fully considered but they are not persuasive. Applicant presents four main arguments as to why the prior art does not render the pending claims obvious: 1) that the prior art does not teach the same sequence of process steps, 2) that the prior art does not form a v-shape, 3) that the prior art does not teach the recited etch/dep ratios and 4) that the prior art does not teach the formation of multiple oxide layers. The examiner disagrees with applicant's allegations and has decided to maintain the rejection.

With respect to the first point, while applicant does make a good point that the order in which the steps are performed may not be obviated by teachings that show a process steps may be done at different conditions, the applicant has overlooked the fact that the Papasouliotis et al. reference teaches repeating the cycle a number of times. Because the pending claims have an open transition, i.e. "comprising" they do not exclude any additional process step. In this case, it is true the prior art to Papasouliotis et al. teaches a cycle where the two process steps are performed in the reversed order from what is recited in the claims, but the reference also teaches performing the cycle multiple times, see column 6, lines 8-10. Thus, because the claim does not exclude additional process steps, the first step of the claims may be viewed as the second step of the first cycle in the prior art, and the second step in the claim as the first step of the second cycle in the prior art. Hence the limitation is met and the claim is rendered obvious.

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Applicant second argument is that the prior art does not teach a v-shape. The examiner draws applicant's attention to figures 1A-1D, as cited in the rejection above and in the previous action. The examiner does not understand how figure 1D does not show a v-shape. Applicant's argument is not persuasive with respect to this point because Figure 1D shows nothing but a v-shape.

Third, applicant asserts that the prior art does not teach the etch/dep ratio. The examiner has presented that the prior art to Papasouliotis et al. teaches that this and other variables are result effective and thus would be obvious to optimize. Applicant has not argued this point and instead only restated what the rejection presented, i.e. that the specific values are not taught. This is not persuasive.

Fourth, and finally, the applicant argues that the prior art does not teach forming multiple layers. The examiner is confused by this allegation because the prior art teaches forming oxide material by repeating a two step cycle, wherein during each step of each cycle an oxide material is deposited. Thus, because each step of each cycle deposits a layer, each cycle deposits two layers and because the cycles are repeated the prior art actually teaches depositing a number of oxide layers. Thus, this argument is also found not to be persuasive.

For the above reasons, the examiner has decided to maintain the rejection as presented in the previous office action.

***Conclusion***

5. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.


Any inquiry concerning this communication or earlier communications from the examiner should be directed to Renzo N. Rocchegiani whose telephone number is (571)272-1904. The examiner can normally be reached on Mon.-Fri. 8:00 am - 5 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith can be reached on (571)272-1907. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Renzo N. Rocchegiani  
Examiner  
Art Unit 2825

  
MATTHEW SMITH  
SUPERVISORY PATENT EXAMINER  
TECHNOLOGY CENTER 2800